1. *Describe the practice proposed for recognition, and list its objectives. Detail how the practice is innovative and how it promotes high student achievement.*

The practice proposed for recognition is the *Rain Forest Robotics* program for fourth grade students. The rain forest comes alive when students use Lego Robotics to build and program animals of the region. This practice is rooted in the infusion of educational technology into the curriculum. First, students working in cooperative groups use computers to gather information about the rain forest via the Internet and exchange e-mail with program participants across districts and scientists around the globe. Interactive television supports instruction between classes in two distinct socioeconomic districts and schools. The practice involves learning across the curriculum. Research, literature, and writing, guide, support, and chronicle student work. Experimentation with pulleys, gears, motors, sensors, and timing is essential to creating life-like robotic rain forest animals. Armed with this new knowledge and understanding, students next select, create, and program a robotic animal. Design, color, texture, and attention to presentation is required to create simulated zoo environments within which to showcase these animals. Finally, public speaking is utilized as students present their final projects to an audience.

Specifically, students meet for cross-district instruction on a regular basis. The instructional period is two hours, preceded by a forty-minute teacher planning conference. Instruction is by cooperative design, with the teacher at each location teaming with the teacher at the other location to introduce, demonstrate, and facilitate student learning. Throughout each session, students have multiple opportunities to share ideas and building strategies with their counterparts in the second school. Between sessions, teachers utilize additional instruction time to address research skills, literature connects, scientific concepts, and writing tasks.

The objectives for this Rain Forest Robotics Program include:

- To provide students with an experience that requires the application of academic, technological, and manual skills to a problem that replicates a real life work situation.
- To provide a cooperative educational model that requires/capitalizes on several of the multiple intelligences/strengths of group members to meet success.
- To expand student experience in programming and multi-step problem solving.
- To expand the immediate learning community to include students in a distinctly different environment, additional teachers, and scientists.

Neighborhood elementary schools serve the needs of the immediate community. Within the selected communities students do not interact with peers from other neighborhoods until fifth or ninth grade. This educational isolation hampers participation with students of other backgrounds. This program is innovative because it creates a global learning community for young students. Students gain insight into peers through shared problem solving and learning experiences. Informal interactions reinforce the commonalities among students. Through this positive interaction, all students develop positive images of each other's community, environment, and goals. Teachers rarely risk job security to work in various settings and rarely collaborate with peers in other

districts. This program is innovative because it allows teachers to form collaborative partnerships across district lines, requires risk taking in instructional presentation, and fosters common planning time. Finally, the program is innovative because it introduces young students to advanced work place technology, develops problem-solving skills utilizing the cooperative/team model, integrates standards across disciplines, and provides career awareness.

Students respond to high performance expectations when the learning environment is appropriately challenging. Computers, the Internet, and robotics are each instructional tools that motivate today's elementary youngsters. This program promotes high academic achievement by providing a challenging, appropriate task, access to state of the art technology tools, and the integration of subject matter and skills that mimic life learning.

2. *List the specific Core Curriculum Content Standards, including the Cross-Content Workplace Readiness Standards, addressed by the practice and describe how the practice addresses those standard(s). Provide an example to substantiate your response.*

The Core Curriculum Content and Cross-Content Workplace Readiness Standards addressed by this practice and how that is accomplished include:

Cross Content Workplace Readiness Standards - 2, 3

Students use information technology and other tools for their projects, as well as developing their thinking skills and problem solving abilities as they research and design their rain forest animals, simulate the animals' environment, and provide documentation for the resulting zoo exhibit.

Science Standards – 5.1, 5.2, 5.4, 5.5, 5.6, 5.7, 5.9, 5.10, 5.12

Experimentation and testing of hypotheses is an integral part of the Rain Forest Project as students use their problem solving skills to make decisions on research and design questions. The resulting zoo exhibit demonstrates understanding of the interaction between systems and system components. Students apply mathematics and laws of nature to create the mechanical systems that control their robotic animal.

Social Studies Standards – 6.7, 6.8, 6.9

Students study the geography of the regions of the world that support rain forests to understand the environments they need to recreate. This study also touches upon the human communities that make their home in these geographic locations and how those communities are supported by this environment.

Language Arts Literacy Standards – 3.1, 3.2, 3.3, 3.4, 3.5

In researching and discussing the developments of each project, students use the skills detailed in this set of standards to read, comprehend, and write new material before they build their zoo exhibit. The literature selection, A Day in the Tropical Rain Forest, is used to motivate this unit of study and to provide students with "experience" in the locale. Several writing assignments (comparisons between local and rain forest geography, reactions to a field trip to a related zoo exhibit, narrative sign posts in the resulting zoo exhibit) demonstrate student ability to write for a variety of audiences and purposes.

Mathematics Standards – 4.1, 4.2, 4.4, 4.5

As they build their projects, students use calculators and computers to design movement and calculate gear ratios. They also use mathematics notation and symbols to solve design problems and pose problems that must be addressed through other disciplines.

3. *Describe the educational needs of students that the practice addresses. Document the assessment measures used to determine the extent to which the objectives of the practice have been met. Provide assessments and data to show how the practice met these needs.*

Technology can be a powerful tool for enhancing student achievement. It is often challenging for educators to find meaningful ways to infuse technology directly into the curriculum. Teachers have recognized that a student who is not prepared to use technology as a tool for discovery and critical thinking skills to problem solve is one that is not prepared for the global community of the 21st century. The robotics program provides early exposure to a variety of technologies. Today, more than ever before in our history, videoconferencing is an effective communication tool for workplace meetings, strategy sessions, and the sharing of ideas. This program provides students first hand experience in this arena. Computers become instruments of research, communication, and design. Robotic technology is not used at any other level in our schools. The problem solving and inventive nature of the program is a tremendous aid in developing critical thinking skills among this group of students. Employing cooperative group strategies and teleconferencing rounds out the workplace readiness component of this program.

Unfortunately, New Jersey is recognized nationally for one of the most segregated public school systems in the nation. This is in large measure due to local control and neighborhood schools. As such, many schools, and more specifically the two schools in this program, do not provide students with adequate exposure to peers of other cultures. This segregation creates false impressions of the values and goals of the other population. The partnering of schools across socioeconomic levels and cultural divides provides for first hand experience with these different groups. Several face-to-face encounters extend the classroom experience. The positive nature of this program permits students to look at each other through similar, rather than distinct, lenses. As children break through stereotypes, they gain valuable life experience.

The affective and cognitive components of this program lend themselves to multiple measures of assessment. Traditional tests of the concepts and material addressed, demonstrated student knowledge and understanding of facts related to the rain forest regions. State ESPA rubrics for writing and public speaking skills were consistently utilized to evaluate student progress. Classroom teachers noted positive gains for all students in these two areas. Building ESPA scores in both schools showed strong gains in Language Arts Proficiency (a 26% gain and 6% gain respectively). While these scores cannot be attributed to this program or class specifically, the emphasis this program placed on those skills has had an effect on student progress. The culminating project – the animal in a simulated zoo exhibit - was also graded with a rubric that addressed presentation, design, and attention to duplication of actual

environments and animal movements. Informal teacher observations and students' own comments were used to note affective growth of the students participating in this program. Finally, students saw themselves as members of a global community of learners, ready and able to reach beyond their immediate environment to solve a common challenge.

4. Describe how you would replicate the practice in another school and/or district.

This program was initially funded through a State Pairing and Sharing Grant. However, it is replicable on a variety of levels. Curriculum guides are in development to assist in program dissemination and for replication purposes in other districts. To meet the academic and work place goals, a district need only to adopt this curriculum and purchase appropriate Lego bricks, CRX's smart bricks, and MindStorms software. A single computer within a classroom is sufficient to conduct group Internet research and access the MindStorms robotic programs. The staff currently engaged in this project is available by phone, e-mail, or visit to assist others in the implementation of this curriculum.

Midrange replication is possible in any classroom or building that has a digital video camera and a computer with Internet capabilities. Such a classroom could connect for a modified, shared experience. As computer video cameras become more versatile, this technology might duplicate the teleconferencing experience at a lesser cost.

The entire model, addressing cognitive and affective development of students, is easily replicated in a district/school that has access to video-conferencing with the new school becoming a partner to the existing program. Through participation, the new school's instructional staff can begin participation as a partner in planning and a facilitator in implementation. Through experience, the new partner teacher will gain the ability and knowledge to become an integral member of the teaching team. As funding permits, virtual and actual field trips provide opportunities for participants to meet and learn about and from each other.

Our experience has generated much community support from parents and others who see this program as a way to engage students in meaningful scientific research, prepare them with life work skills, and increase their comfort with peers in other settings. Many organizations and businesses are interested in funding just such experiences. It is conceivable that a school or district interested in replicating this program could adopt our Pairing and Sharing goal to successfully gain grant funding to purchase the equipment necessary for full implementation.